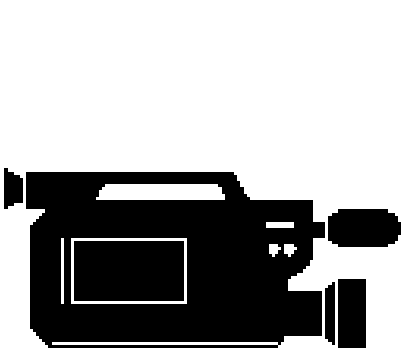


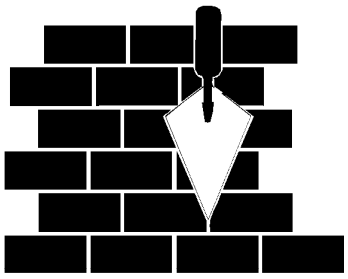
Indiana

# Technology Education

## Curriculum

## Facility Planning Guide

2000 Edition



Indiana Technology Education

# Facility Planning Guide

## 2000 Edition

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## SCOPE OF TECHNOLOGY EDUCATION

Technology Education is a foundational area for the essential education for every child enrolled in Indiana's secondary schools. Technology Education programs provide opportunities for students to develop technological literacy and competence in the major human productive areas of communication, construction, manufacturing, and transportation. The experiences are designed to help each student understand the technological systems used by each of these areas. Students investigate these systems and subsystems with emphasis on their inputs, processes, outputs, goals, and impacts.

The mission of Technology Education is to develop, within students, the ability to actively participate in designing, producing, selecting, using, and assessing technology with concern of the individual, society, and environment. The goals inherent in this mission area help learners to:

1. Appreciate the evolution of technology with particular focus on the present and the future.
2. Establish values on the impacts of technology and how it alters the natural and human-made environments.
3. Develop knowledge and ability to properly use the tools, techniques and resources of technological systems.
4. Develop creative solutions to present and future societal problems using technical means.
5. Develop their potential for responsible work, creative leisure and responsible citizenship roles in technological society.

In the planning of new Technology Education facilities and as current facilities go through a series of progressive changes as new content, activities and equipment are added, it is important to establish the criteria by which decisions should be judged and made.

## PLANNING FOR CONTEMPORARY TECHNOLOGY FACILITIES

Contemporary Technology Education programs are multi-disciplinary in nature. Thus, facilities will need to be capable of supporting a number of diversified activities. Provisions will need to be made for learning experiences wherein learners process and/or evaluate materials, energy and information, plan cooperatively, discuss problems, share information and insights, and work as individuals and in teams to produce results. What is needed are comprehensive and flexible facilities capable of supporting both present and future Technology Education program needs. Comprehensive facilities should be capable of supporting content and laboratory activities in the areas of communication, construction, manufacturing, and transportation (refer to page 3).

Flexible technology facilities will need to be capable of supporting diversified and multiple learning activities. This capability should be enhanced through the use of mobile, flexible and integrated services, equipment and working/learning stations. Working/learning stations can be stationary, but more often are mobile work stations or units that provide learners work surfaces, appropriate services and support instructional materials and/or apparatuses. In this manner, as methods, content and learner needs change, work units and stations can be appropriately re-configured.

The equipment used in a flexible technology laboratory should be both readily available from a number of suppliers and it should be flexible in configuration and use. Whether the equipment be standard (i.e., the equipment typically found in a general shop, such as a drill press, joiner, circular saw, etc.) or flexible (or equipment capable of being used to perform more than one task, such as computers, material testing equipment, etc.) mobility should be considered as a criteria for its selection and use.

Machines and support equipment or units should be selected for their comprehensiveness, flexibility and usability. In comprehensive and flexible Technology Education facilities the use of tabletop equipment should be commonplace.

Usable Technology Education facilities should consist of transformable learning environments capable of being used to support the study of technology–based systems. In a transformable learning environment the learners and instructors should be able to transform, use and rearrange the work/learn stations, machines, equipment, and services to create special learning zones as needed. Services in a transformable environment should be delivered from flexible overhead systems; thus, reducing the restrictions placed on the configuration by the use of only floor and wall delivery systems.

## FITTING PROGRAMS INTO LABORATORIES

The space requirements of this document have identified the recommendations for new technology facilities. These facility recommendations are designed to support the courses included in the Indiana Technology Education Curriculum Model. The purpose of this section is to identify the courses from this model that would be most appropriate for the identified laboratories.

This document provides recommendations for five (5) major facilities. These include: Communications, Construction, Design and Planning, Manufacturing, and Transportation laboratories. The recommendations also call for an instructional and planning room for each of the laboratories except the design and planning area. New facilities, because of differences in school populations, will differ in the number of laboratories. Therefore, three (3) general course recommendations will be made. Schools with programs and facilities that vary from the general recommendations should adjust the course recommendations to best fit their needs and facilities.

The three (3) general course recommendations are as follows:

1. For junior high/middle school and senior high facilities consisting of one (1) major facility and a design and planning area.
   a. A junior high/middle school facility should be capable of supporting the activities of the introductory Technology course.
   b. A senior high facility should be capable of supporting all fourteen advanced Technology Education courses.

2. For junior high/middle school and senior high facilities consisting of two (2) major facilities and a design and planning area.
   a. A junior high/middle school facility should be capable of supporting the activities of the introductory Technology course.

b. A senior high facility should support all Technology Education courses at the eighteen (18) or thirty-six (36) week format. Appropriate courses to be located in each facility include:

- *Manufacturing and Construction Laboratory*: The system and process level courses in manufacturing and construction and appropriate courses from the application level.
- *Communication and Transportation Laboratory*: The system and process level courses in communications and transportation and appropriate courses from the application level.
- *Design and Planning Laboratory*: The design processes course and appropriate courses from the application level. Also, selected activities from all other courses.

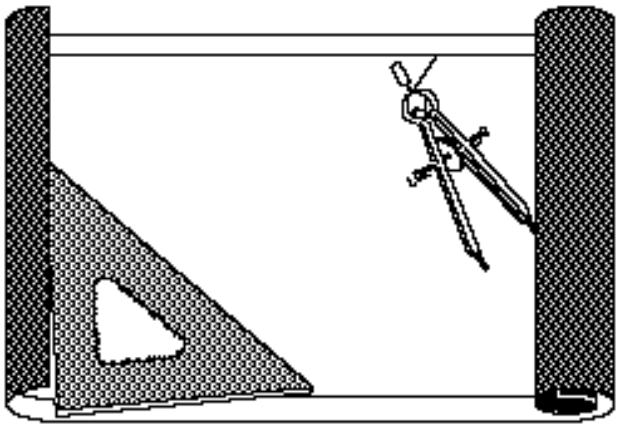
3. For junior high/middle school and senior high facilities consisting of four (4) major facilities and a design and planning area.

a. A junior high/middle school facility should be capable of supporting the activities of the introductory Technology course.

b. A senior high facility should support all Technology Education courses at the eighteen (18) and thirty-six (36) week format. Appropriate courses to be located in each facility include:

- *Communication*: The system and process level courses in communications and appropriate courses from the application level.
- *Construction Laboratory*: The system and process level courses in construction and appropriate courses from the application level.
- *Manufacturing Laboratory*: The system and process level courses in manufacturing and appropriate courses from the application level.
- *Transportation Laboratory*: The system and process level courses in transportation and appropriate courses from the application level.
- *Design and Planning Laboratory*: The design processes course and appropriate courses from the application level. Also, selected activities from all Technology Education courses.

Planners of new technology facilities should make note of the heavy use of the Design and Planning laboratory. This occurs because of the increased cognitive nature of the new curriculum and the fact that this facility is often used in conjunction with the other major laboratories.

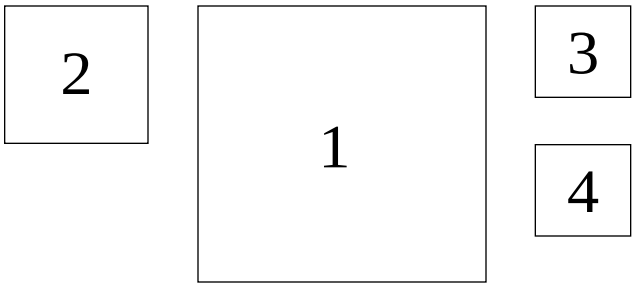


## SPACE REQUIREMENTS FOR TECHNOLOGY FACILITIES

The following table shows the minimum recommended space requirements for Technology Education program facilities in Indiana:

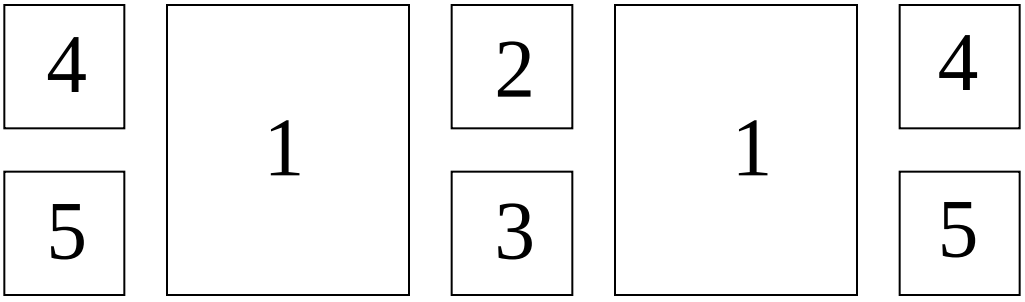
| Laboratory Type | Laboratory Area | Activity Storage | Equip. & Mat'l Storage | Planning & Design | Instruction & Planning |
|---|---|---|---|---|---|
| Single Lab | 2400 | 200 | 300 | 1000 sq. ft. combined total | |
| Double Lab | 2400 each<br>2400 each | 200 each<br>200 each | 300 each<br>300 each | 1000 | 500 |
| Ea. Add'l Lab | 2400 | 200 | 300 | | 500 |

### *Single Laboratory Facility:*



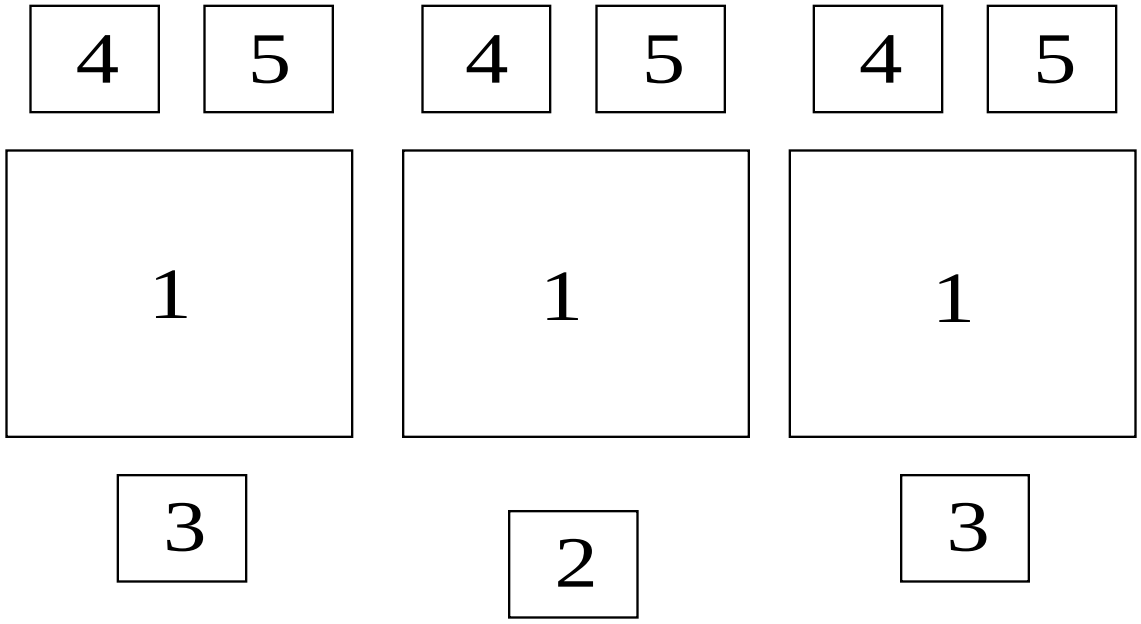

1. Laboratory area: 2400 square feet.
2. Planning, design, and instruction area: 1000 square feet.
3. Activity storage: 200 square feet.
4. Equipment & material storage: 300 square feet.

### *Double Laboratory Facility:*




1. Laboratory area: 2400 square feet.
2. Planning & design area: 1000 square feet.
3. Instruction & planning area: 500 square feet.
4. Activity storage: 200 square feet.
5. Equipment & material storage: 300 square feet.

***Triple Laboratory Facility:***




1. Laboratory area: 2,400 square feet.
2. Planning & design area: 1000 square feet.
3. Instruction & planning area: 500 square feet.
4. Activity storage: 200 square feet.
5. Equipment & material storage: 300 square feet.

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**DESIGN FLEXIBILITY AND USE**

1. Technology laboratories are designed to provide facilities for communication, construction, design, manufacturing, and transportation experiences.

   In the design phase of these facilities, one important concept is flexibility. The variety of activities, the ever changing placement of machines and tools, and the variety of tools and equipment make it necessary to provide quick and easy access to utilities such as compressed air, electrical connections, dust collection systems, and exhaust systems.

2. These minimum space requirements are for one-teacher laboratories. Office space should be provided for each Technology teacher. However, it is recommended that one common office area be provided for the entire faculty. If appropriate for the facility, this office may be shared by teachers in other departments.

3. The Instruction and Planning area of 500 square feet should adjoin the laboratory area; the partition between the two areas should contain maximum glass area to permit adequate observation of student activities from either side.

## DESIGN CONSIDERATIONS

The following is a list of considerations that designers and planners of Technology Education facilities should take into account for each of the major laboratories:

### *Communication Laboratory*

- Should have electrical, plus air and cable television hookup services available.
- Should have access to the internet in the area.
- Should have provisions for television and photography lighting.
- Should have acoustically treated walls in photography, radio, and television areas.
- Should have activity, equipment, and materials storage rooms.
- Should have shatterproof glass between the instructional and planning area, and the laboratory.

### *Construction Laboratory*

- Should have large doors opening to the exterior of the building measuring a minimum of 8' x 8'.
- Should have large concrete and/or earth pads outside the door opening for exterior construction activities.
- Should have the following services available: electrical, air, natural gas, and flexible dust exhaust.
- Should have activity, equipment, and materials storage rooms.
- Should have shatterproof glass between the instructional and planning area, and the laboratory.

### *Design and Planning Area*

- Should include computers and access to the internet.
- Should be in close proximity to the Construction and Manufacturing laboratories.

### *Manufacturing Laboratory*

- Should have the following services available: electrical, air, natural gas, and flexible exhaust for dust and fumes.
- Should have a flexible management area in the instruction and planning area.
- Should have activity, equipment, and materials storage rooms.
- Should have shatterproof glass between the instructional and planning area, and the laboratory.

### *Transportation Laboratory*

- Should have access to the exterior of the building (sun, wind, large fields, etc.).
- Should have the following services available: electrical, air, natural gas, and flexible exhaust for fumes.
- Should have a fabrication area for the building of models, equipment, and prototypes.
- Should have activity, equipment, and materials storage rooms.
- Should have shatterproof glass between the instructional and planning area, and the laboratory.

## INSTRUCTIONAL AREA: GENERAL CONSIDERATIONS

### *Laboratory Locations*

Technology laboratories need to be located on the ground level. This is necessary due to the weight and vibration of the equipment. Also, it will be easier to get supplies in and out of the facilities.

### *Laboratory Shapes*

The full laboratory area should be available for instructional purposes without partitions or other barriers. Long narrow laboratories are to be avoided and contours used which allow an instructor full visibility of the entire facility.

### *Floors*

Floor covering appropriate to the nature of the room activity is recommended. Carpeting in planning and design area, resilient tile or hardwood floors for general work areas, and surface-treated concrete where grit, oil, or water are present in quantity are good selections.

### *Walls*

The lower portion of walls should be free from obstructions to allow for the placement of benches, machines, and cabinets. Light reflecting paint colors should be used with scrubable surfaces around points of wear. Scrubable means a glazed, nonporous surface such as produced by epoxy paint or ceramic tile.

### *Ceiling*

Ceiling height should be at least 10 feet, and 12-14 foot ceilings should be provided whenever possible. These heights should be clearance below light fixtures. Materials with high sound absorption and light reflective qualities should be used.

### *Lighting*

The Illuminating Engineering Society recommends the following foot candle standards:

- 70 fc: classrooms, general assembly, testing, inspection.
- 100 fc: drafting, general assembly, testing, inspection, counter displays.
- 150 fc: fine drafting, fine assembly, testing, inspection, display lighting, severe and prolonged seeing tasks, medium severe office tasks.

Planning and design area should be distributed and diffused to avoid all shadows.

### *Windows*

Use of windows in certain partitions will help to provide an open atmosphere and aid the instructor with classroom control.

### *Machines*

A minimum number of machines should be permanently located. Areas such as the foundry area should be planned in a permanent location. Heavy machinery such as a planer should be permanently mounted on vibration pads. Nearly all machinery will be of the size and type to allow for flexibility in configuration.

### *Storage*

Provision for storage must follow IOSHA* standards. Vertical racks are recommended for storing long or sheet materials. Cabinets should provide for storage of supplies. For safety reasons, large quantities of wood and metal should be stored on low level horizontal racks. Open shelving (24" deep) should be provided.

* IOSHA: Indiana Occupational Safety and Health Administration (OSHA General Industry Standards, U.S. Department of Labor)

Shelves for student books should be provided. Appropriate metal cabinets are required for storing paints and other inflammable material. Locked storage for student work should be provided in certain laboratories.

### *Display Cases*

Display cases, equipped with locked doors and indirect lighting, at a location near the laboratory and also in the foyer of the building, should be provided.

### *Electric Service*

A master switch panel should be mounted in a convenient place inside each laboratory. Each circuit should have a circuit breaker and switch. Remote control safety switches (emergency disconnects) should be located on each wall of the laboratory. Multiple 110 volt duplex outlets should be provided on all the walls above bench height. Ceiling bus runs should be provided to service multiple equipment locations. Heavy duty service should be provided for kilns, welders, furnaces, etc. IOSHA standards must be followed.

### *Plumbing*

A hand-washing and general use sink should be located near the main entrance to the laboratory. An additional sink with special trap should be provided for the ceramics area and a developing sink for darkrooms. A drinking fountain should be provided adjacent to the sink.

### *Fume Exhaust*

A hood to collect and carry off smoke and fumes should be installed over areas such as foundry and welding. Avoid using a common duct for sparks and for combustible fumes. In the transportation and manufacturing areas, provision should be made to exhaust fumes. Portable units can serve applications involving ceramic glaze, abrasive grit, and aerosol sprays. Locate all exhaust and compressor mechanical units outside of instructional areas, preferably in a mechanical room.

### *Dust Collection*

A ceiling mounted flexible dust collection system must serve machines such as the circular saw, radial area saw, lathes, band saw, jointer, shaper, sander, and planer. The mechanical unit should be located outside the laboratory. Specifications should include collectors for each machine.

### *Compressed Air*

Compressed air should be supplied from a central source outside the laboratory with sufficient outlets available in each facility.

### *Fire Protection*

Appropriate fire extinguishers and fire protection equipment of sufficient capacity shall be provided for each laboratory.

### *Doors*

Doors must swing out if there are more than 50 people in the room at any time, and each laboratory should be equipped with two (2) doors. Doors shall also be provided to allow access to each laboratory for the purpose of moving equipment and supplies. A double door without a center post or with a removable post will serve this purpose and will also serve as another means for student exit. In any event, the principles of flexibility and curriculum change must be considered in the selection and placement of doors.